REPORT OF TRIP TO THAILAND

December 30, 1969
to
January 30, 1970

by

John F. Douglass

Soil Conservation Service
U. S. Department of Agriculture
Washington, D.C.

This report was prepared during a 4-week visit to Thailand on invitation from the Department of Land Development of the Ministry of National Development, Royal Thai Government, to participate in the First ASEAN[1] Soil Conference and advise on soil survey activities. The trip was supported by the United States Overseas Mission (USOM), Thailand, and arranged by FEDS through the SCS-PASA, USDA, and the USAID Washington office.

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[1] Association of Southeast Asian Nations (Indonesia, Malaysia, Philippines, Singapore, and Thailand)

Introduction: I was invited to work for one month in Thailand, spending about 2 weeks participating in the First ASEAN Soil Conference and about 2 weeks providing technical advisory services on soil survey activities to staff members from the Soil Survey Division, Department of Land Development, Ministry of National Development, Thailand.

The purpose of the First ASEAN Soil Conference was to permit soil scientists and agronomists from the ASEAN countries of Indonesia, Malaysia, Philippines, Singapore, and Thailand to assemble at a conference and present and discuss results of their latest research relating to farming in tropical areas. About 47 papers were presented by the delegates at the conference. My invitational paper, Application of Soil Taxonomy (7th Approximation) to Soil Surveys, was oriented to tropical conditions. Many of the concepts outlined in the Soil Taxonomy, a general basic system of soil classification developed in the United States to use in making and interpreting soil surveys, are used in whole or part by most of the countries and international organizations represented at the conference. The purpose of the paper was to explain and discuss the principles of this new taxonomy and especially its application to making and interpreting soil surveys.

Six field excursions were made during and following the ASEAN Conference. About 80 people participated in each of the first three excursions, nine in the fourth, three in the fifth, and eight in excursion number six. Observation pits and profile descriptions had been prepared in advance for most of the excursions. Other unscheduled

stops were made to observe soils, crops, work at research stations, and other special management aspects of farming. A total of about 36 soils were observed. In discussion lasting about 30 to 90 minutes at each site ideas were exchanged about the classification and interpretation of the soils in the systems used by representatives from the various countries. The importance of understanding and being able to relate various kinds of soil classification systems was demonstrated during these discussions in which workers explained their experience and research on similar kinds of soils in other countries.

The new Soil Taxonomy was tested in the field and, for the most part, seemed to work as well in tropical climates such as Thailand as it does in the temperate, subtropical, and tropical climates of the United States. The field testing provided an excellent opportunity for the soil survey supervisors in Thailand and others to become better acquainted with the new soil classification system and to apply the criteria that differentiate important characteristics of soils.

Objectives of Assignment: To provide technical advisory services to assist the Department of Land Development, Ministry of National Development of Thailand in its efforts to improve the technical and scientific capabilities of its technical personnel. This training will be helpful to the Department in carrying out its responsibility of providing a modern soil inventory as soon as possible. Information about the soils is needed for broad planning of the use of national, provincial, and district land and water resources and for detailed planning of individual farms.

My specific objectives and their significance to the country are:

1. Participate in the ASEAN Soil Conference by giving paper on the application of Soil Taxonomy. This presentation provided an opportunity for soil scientists in Thailand and observers to offer criticism and make suggestions for needed changes in the Soil Taxonomy so that the criteria for the taxa would satisfy their needs for distinguishing important soils.

2. Evaluate the Department of Land Development (DLD), soil interpretations, land capability classification, and soil survey programs.

   The work of the soil survey and its related activities of land capability classification and soil interpretations has been conducted by the DLD since 1963. Before that the work was scattered among different departments. The Department employs a total of about 552 in the soil survey division with 42 field parties and about 459 in the land classification division. In respect to the short time these programs have been in operation and the large staff involved, the DLD's progress has been commendable; however, they are interested in increasing the quality and quantity of the soil maps and/of applications of the interpretations in land use planning.

3. Have conferences and field studies with FAO UNDP -SF- Soil Survey Project officers.

   The FAO is providing assistance to the DLD soil survey and land classification projects. Their staff consists of a project officer and about nine specialists, experts, and technical officers. The

USOM-SCS-PASA team formerly assisted the DLD soil interpretation program; however, this assistance has ended, and present plans are that the FAO staff will undertake assistance in that program as well as carry on their present program of assisting the soil survey division.

Recommendations: All recommendations in this report, including the tentative placement of soils in the Taxonomy, Appendix V, are based on limited time for detailed studies and, consequently, should be considered within the context of tentative suggestions.

1. ASEAN Soil Conference. I concur in the recommendations of the delegates from the ASEAN countries that this conference be continued (Appendix I).

   This First ASEAN Soil Conference was organized in a professional manner by the Thai Government. The meeting facilities and tour arrangements were excellent. It is difficult to assess the value of the conference in terms of economic cost and returns; however, the cost of this kind of training is probably small in respect to the long-time benefits that should accrue to the DLD. Much of the research that was presented in the various papers has direct application to the problems that soil scientists and agronomists have in their daily work. The conference provides an incentive for local scientists to conduct research, write papers, and increase their professional competence. As the conference expands in future years, more of the staff will have opportunity for leadership on committees, serving as chairmen of the sessions, conducting tours, and other functions.

2. Department of Land Development - soil interpretations, land capability classification, and soil survey programs.

a. Soil survey interpretations and land capability classification.

The broad activity of making soil surveys and interpreting them for various uses is divided among different teams in Thailand, each working somewhat independently--one for making the actual soil survey; another for making land capability classification surveys; and other teams for soil survey interpretations. The objectives of all these projects are intimately related because soil interpretations, as well as land capability classification, are based on the soil characteristics recorded in soil surveys. Close integration of these projects should help eliminate duplication of work. Following are suggestions on how soil survey interpretations may be improved:

(1) Gathering data on crop yields.

Too few data are available to accurately predict the results of alternative management systems by kinds of soil. Collecting information to improve soil survey interpretations is now a major function of the soil interpretation teams. This activity should also be a part of the work of technicians who make the soil surveys and of those who make land capability maps. By increasing the number of people gathering data on crop yields, a wider variety of experience would be available; and the data should produce more reliable interpretations.

I did not have opportunity to observe the field methodology for collecting data; consequently, inferences drawn from a report presented at the First ASEAN Conference, entitled Soil Interpretations of Khon Kaen Province, are used to illustrate certain principles. The report rightly concludes "that management factors such as rainfall, time of planting, and all other cares affect the yield of crops." Data in tables 6 and 7 on page 6 of the report summarize rough rice yields in kg per rai for the 3-year period, 1966 through 1968, from replicated plots selected among eight different soils at 30 different sites. The average yields ranged from a high of 462 for the Phimai series (map unit Pm) to a low of 186 for the Roi-Et series, clayey, low phase (map unit Re-cl), a difference of 276. The percentage difference between the highest and lowest actual yields recorded in the 3-year period for the eight soils ranged from a high of 1200 percent for the Roi-Et series (map unit Re) to a low of 185 percent for the Roi-Et series, saline phase (map unit Re-sa).

Thus, seven of the eight soils had wider ranges between the high and low yields for the same soil than the total difference in average rice yields among the eight soils. For example, for the first soil listed, the Phimai series (map unit Pm), the high yield was 942 and the low 125, a difference of 817 (650 percent) or about three times more than the total difference in all soils.

These data should not be interpretated to mean simply that management factors alone are responsible for all the differences in crop yield as might be inferred. The nature of the soil also is important. The data seem to suggest the following:

(a) That plots for gathering data be located on uniform soil areas.

Even with the best care, this is not easy to do especially under field trial conditions. Chances of error in locating uniform plots can be tested by eliminating all variables of management. If wide differences in yield still persist, then one must suspect that different kinds of soil are involved and reasons to establish a new soil map unit may be apparent. The fact that this can happen is one example of why soil surveyors should collaborate with other technicians in designing map units. Wide differences in crop yields can suggest differences in soils that are not revealed by soil maps, especially if the maps are smaller in scale than about 1:20,000.

(b) That crop yields reported for a specific kind of soil always be in terms of the exact accompanying set of management practices.

All elements of management that may influence crop yields should be included. For practical work in collecting crop yield data, it is necessary to establish one or more levels of management that are commonly used in the farming area being studied. In some areas of Thailand, this may be one level for the traditional or common methods of farming, another for a moderate system of management, and another for a combination of all the best management techniques, producing the highest economic crop returns. In some other areas, the traditional level of management could be dropped; and in some areas, the highest level of management may be the only significant level from which to report crop yields. Each level would be defined by a set of management practices that under normal conditions would produce crop yields varying less than about 25 percent from the average.

Most soils in Thailand are not highly productive if only simple management practices are used. But many of the soils have high potential if enough plant nutrients including trace elements are supplied and if the soil moisture supply and other production factors are managed properly.

It is important, however, that soils with high potential, usually those with favorable chemical and physical characteristics, be recognized as separate mapping units from those with low potential because the rate of return of investments is vastly different.

High levels of management are usually profitable on "favorable" soils but much less important on "unfavorable" soils. This can be demonstrated for single practices, such as improved water management, and is even more striking if a complete set of needed management practices is used such as adapted crop varieties, fertilizers and tillage and insect, moisture, and weed control.

(c) That the gathering of crop yield data be a continuing process over a long period of time.

Long-term data tend to integrate wide fluctuations in climate, incidence of crop disease, weed infestations, and other events that may cause variations in crop yields. Also, the benefits of some management practices such as crop rotations, residual effects of fertilizers, soil drainage, or land leveling may accrue slowly and can be reflected best if crop yields are averaged over about 5 years or more.

(d) Data on yields for pasture, forest products, fruit, and vegetables should be collected by kinds of soil as is done for the more common crops.

Information on crop yields and their accompanying management practices for these farm products is not as well known as for rice, kenaf, and rubber. Information is particularly needed on forest products, pasture, and in some places, fish farming because these crops may offer the best alternative uses for some soils. For example, fish farming appears to be an alternative for higher economic returns and at the same time to be the best land use for certain soils that should not be drained, such as the strongly affected "acid sulfate soils."

(2) Gathering data for engineering interpretations.

A demand for data on soil behavior as it relates to engineering interpretation is increasing. The AASHO and Unified soil classification systems used by engineers are already included in some soil survey reports. Other soil groupings that can be derived readily from basic soil survey data and would increase the value of soil survey reports, particularly when used by engineers, are:

(a) Hydrologic soil groups. Engineers use these in planning watersheds. Discussions were held during the field excursions on how to make these groupings.

(b) Soil permeability - Refers to the rate at which water infiltrates and goes through the soil and is important for locating septic (sanitary) systems.

(c) Foundation stability - Refers to the ability of a soil to support a given weight without collapsing or settling.

(d) Soil wetness - Refers to the depth to a seasonal or permanent high water table.

(e) Flooding hazard - Refers to the amount of flood threat by kind of soil.

(f) Ground water supply - Indicates the amount of ground water suitable for human consumption that is available in different soil areas.

(3) Training and leadership.

Technicians specializing in soil survey interpretations also should be trained soil surveyors because one objective of soil survey interpretations is to demonstrate how soil surveys can be used. In addition to training in making soil surveys, staff members who specialize in soil survey interpretations should be trained in agronomy and should have a strong background in forestry, horticulture, range, economics, agricultural engineering, and journalism. These are somewhat rigid requirements but emphasize that interpretation specialists should have high qualifications.

More on-the-job training should be given to the Soil and Water Conservation Center chiefs and their staffs to enable them to relate their research to specific kinds of soil.

A detailed soil map, scale 1:2000, had been made of the Conservation Center we visited at Khon Kaen. This map along with help from the soil surveyors can be helpful in extending the research at this center to other areas of similar soils. The staff members at the center have good opportunities for leadership at scheduled field days in promoting the use of soil surveys and their interpretations.

b. Soil Survey

My impression is that progress has been good in most aspects of the soil survey program, including soil survey interpretations and land capability classification. The following comments emphasize some features of the soil survey program that probably are adequate in some parts of the country but need to be strengthened in other parts.

(1) Soil survey work plans, descriptive legends, and laboratory work plans are needed for each soil survey area.

A soil survey work plan is a document that outlines a sequence of events for a period of time. It helps to coordinate all the work that will take place in a soil

survey area from the beginning of the survey through all the more or less overlapping stages to the final publication of the soil survey. An important part of the work plan includes decisions about the mapping and publication scale of the maps. It is reasonable to expect that the intensity of soil use will vary from one area to another and that the scale of mapping will vary accordingly. Maps at scales smaller than about 1:20,000 may serve the required purposes in ranching and forestry areas but may not be adequate in intensive farming areas where detailed maps are needed to predict how soils will perform and what management is needed at specific places.

Descriptive legends include a list of all the soil mapping units in a soil survey area, their descriptions, and symbols. They are necessary to correlate the mapping units and to provide continuity of the work in case the party leader or other key men in the party are transferred. They are useful for providing a permanent record of changes during the course of the survey.

Laboratory work plans help insure that needed laboratory work is accomplished in time to benefit the soil surveyors during the survey and for final correlation of the mapping units. They also help coordinate the laboratory research needs of one soil survey area with those of other areas to avoid unnecessary duplication of work.

(2) Soil correlation needs to be strengthened.

Soil correlation is an important part of a soil survey program. The objective is to insure that similar kinds of soils are classified under the same name and that the units of classification shown on soil maps are defined in terms of sets of characteristics that are significant to soil behavior when the soil is used. Accurate soil series and mapping unit description are prerequisites to an effective soil correlation program. All recognized phases of a soil series should be included within the range of the soil series in which they are classified. The range of characteristics of one soil series should not overlap the range included in another series or that of a higher category. Soil correlation, mapping, classification, and interpretations are related and in practice are accomplished in somewhat overlapping stages. Correlation, to be most effective, must start at the field level by the party leader and his staff; then it must be reviewed at each level of responsibility, as high as the person responsible for the countrywide soil correlation.

The current emphasis by the soil correlation staff on improving individual soil descriptions should be continued. This will require some additional field studies because the ranges in characteristics of some soil series overlap those of other series.

(3) Training.

All the soil scientists I had opportunity to observe in Thailand were conscientious in their work and interested in improving their understanding of soil science. A few can do this with graduate work outside the country; however, the majority probably will have to rely on self-improvement by studying the current literature,by work conferences, and by on-the-job training within the country.

(a) A small library is available at the Division headquarters in Bangkok. Current plans are to expand its facilities to include at least a part-time librarian. This should help make reference materials more available to field men.

(b) Work conferences should be expanded. The first ASEAN Soil Conference is one type of training conference that is beneficial. In addition, smaller work conferences held by regions during the slack season of field work can be helpful especially for training new men. New techniques in soil surveys and practice in writing soil series descriptions and draft sections of manuscript reports should be emphasized.

(c) On-the-job training should be increased for members of soil survey parties. Individual party members need this training to maintain their proficiency

in all soil survey work including soil classification. Some aspects of soil survey in which party members, especially new ones, need more practice are: Recognizing diagnostic soil horizons; estimating soil texture in the field; determining soil colors, structure, and consistence; recording notes; and writing draft soil series descriptions.

(4) Need for additional combined laboratory and field studies.

Routine laboratory characterization work on selected soils and some special soil survey investigations are now being conducted. Many additional problems relating to soil classification, soil behavior, and soil interpretations require both laboratory and field attention. These problems should be described in laboratory work plans so that laboratory personnel can make provisions not only to perform the required work in the laboratory but actually direct and assist in collecting the soil samples and in writing the field descriptions. This will train soil surveyors in the proper method of collecting soil samples and describing soils and also will enable laboratory personnel to gain insight into the problems to be resolved.

(5) More emphasis should be placed on applying soil surveys.

Soil surveys are made for practical purposes and should be designed to benefit many kinds of users. To achieve these objectives, the soil survey staff should collaborate with other technicians such as planners, foresters, engineers, and farmers so that the soil mapping units shown on the maps have the highest possible utility.

A published soil survey includes maps and description of the soils and their interpretations. Even if published soil surveys are written as clearly as possible, some potential users, including some cultivators, will need additional help in applying the information. The soil survey staff can exert strong leadership in helping others to use soil surveys. They can do this in part by preparing special publications, participating in meetings that explain the use of soil surveys, and in private conversations with individual users.

3. FAO Assistance Program.

The FAO of the United Nations has been assisting the Thai Government with soil surveys since 1961. The United States Operations Mission (USOM) through the SCS-PASA team also has assisted the soil survey program by contributing financial and advisory support and equipment. The USOM assistance mainly was directed to the soil interpretations program; however, this assistance has ended.

It is recommended that FAO carry out their present tentative plan to continue and even expand the advisory work relating to soil interpretations that was started by USOM. The work of making soil surveys and applying the information are so intimately related that soil maps can be used fully only if a strong interpretations program is in effect.

There are many competent technicians on the Thai soil survey and soil interpretation staffs; however, their work would be complemented by the experience of FAO advisors assigned to specialize in soil interpretations.

Several conferences and field studies with the FAO staff demonstrate their conscientious efforts to strengthen all phases of their soil survey assistance program.

ACKNOWLEDGMENT

I appreciate the opportunity to participate in the ASEAN Soil Conference and the arrangements provided for working in the field. The assignment was beneficial to me because I learned much from the Thai and other soil scientists about their experiences with certain kinds of soils. This information will be helpful in making suggestions for revising parts of the Soil Taxonomy. Hopefully, the mutual exchange of ideas about soil classification, soil interpretations, and soil survey techniques that were discussed in the field and in meetings during the month also will be beneficial to workers associated with the Department of Land Development.

In addition to acknowledging the courtesies and hospitality extended by all officials of the Thai Government whom I was privileged to meet or work with, the following deserve special mention for making this study possible: USOM, Thailand, and USDA-FEDS, Washington, D.C., for arranging and supporting the trip with the cooperation of SCS-PASA; Mr. J. Dale Schott, USOM-SCS-PASA, Team Leader, Bangkok, Thailand, for arranging all local details of work, travel, and official engagements; Dr. Bancherd Balankura, Director-General, Department of Land Development, Bangkok, for the invitation to assist their programs, and his staff, especially Mr. Samarn Panichapong, for making arrangements for field excursions; and Dr. G. H. Robinson, Project Manager, FAO-Soil Survey Project and staff, Bangkok, for counsel and for assistance, especially in studying soils in the Bangkok Plains and in Northeast and South Thailand.

Conclusion and Recommendations

by

Delegates from ASEAN countries

6-17 January 1970

Bangkok, Thailand.

1. The delegates felt that this conference met a real need especially with respect to informing scientists of the ideas, progress and plans of other scientists working on similar problems in the area. All felt that such conferences should be continued in the future. Some conditions were suggested and these were as follow :-

   1. Papers presented should be published and list of those attending should be distributed.

   2. Effort should be made to obtain travel fund from some sources for the delegates.

   3. Date and general nature of the conference should be fixed at least a year in advance and the conference should be well publicized in each country.

2. The delegates felt that the conference should remain as ASEAN conference but that the ASEAN Secretariat might consider opening the conference to other nations in the region and that funds should be sought to be able to invite a certain number of special lecturers without regard to the country.

3. The delegates felt that the ASEAN Soil Conference should be held every two years, and that the next one would be held in 1972.
4. The conference should rotate between member countries. For the next conference in 1972, Indonesia is requested to be the host country.

Suggestions for the next conference were made by several delegates. These were as follows:-

(1) Titles of papers to be presented should be distributed to participants in advance.

(2) Papers should be submitted 60 days in advance according to the format supplied by host country for production. Papers should be collected, produced, and distributed by the host country. If necessary the host government should charge a registration fee to cover the cost of production.

(3) The general theme for the next conference should be on the application of basic soil research data to agricultural development.

(4) Joint sessions covering papers of general interest especially soils of host country should also be arranged.

(5) Possibility of interchange of scientists between member countries for short durations should be looked into. Such conference should also be considered as a starting point for formation of a kind of agricultural society for this region.

S. Panichapong

General Secretary of the
First ASEAN Soil Conference
January 19, 1970

The following materials were furnished to staff members in Thailand:

1. Copy of paper, Application of Soil Taxonomy (7th Approximation) to Soil Surveys. To General Secretary, First ASEAN Soil Conference.

2. SCS procedure for making hydrologic classification of soil series. Also, example showing placement of 24 Northeast Thailand soils in hydrologic groups. To USOM-SCS-PASA, FAO, and DLD.

3. SCS procedure for making forestry suitability groups with soil survey of Fulton County, Pennsylvania and Curry Area, Oregon, to illustrate the groups. To Royal Forest Dept.

4. List of English translations of Polish, Yugoslavian, and Soviet literature on soil science published by USDA and National Science Foundation and instructions on how to order from the Clearinghouse. To FAO and DLD.

APPENDIX III

ITINERARY
JOHN F. DOUGLASS
Dec. 30, 1969 - Jan. 30, 1970

12/30/69	Arrived Bangkok, 9 p.m.
12/31/69	Orientation to work of SCS-PASA team in Thailand by J. Dale Schott, team leader, and tour of Bangkok by taxi, bus, samlar, and walking to observe canal systems, methods of transportation, and other city features. This orientation later proved valuable because I learned how to save time in getting to and from various government offices. Read book by Robert L. Pendleton on soils, history, culture, geology, physiography, climate, and other physical and cultural features of Thailand.
1/1/70	With J. D. Schott. Visited downtown USOM office (office was officially closed due to holiday) and SCS-PASA offices at DLD (Department of Land Development) located at Bangkhen, north of Bangkok. Made short tour of vegetable farm areas in vicinity of Bangkok. Soils are dominantly Vertic Tropaquepts and those not irrigated were developing wide cracks extending downward from the soil surface.
1/2/70	Met officials of USOM (United States Overseas Mission) in downtown office. Discussed engineering interpretations with Arnold Snowden, SCS-PASA team member. A need for hydrologic soil groups was suggested by A. Snowden (SCS-PASA advisor) for use in planning watershed projects.
1/3-4/70	Worked in hotel room revising notes for presentation of paper at ASEAN soil conference and in studying descriptions for 19 soils of Northeast Thailand and in placing them in tentative hydrologic soil groups for use by the engineers.
1/5/70	Met with FAO and Thailand counterpart soil survey staff in offices at DLD headquarters, Bangkhen. Individual conferences with (1) G. W. Arnott, FAO officer-in-charge of laboratory, to discuss laboratory procedures and in particular fractionization of clay-size particles into .002-.001 and <.001 mm fractions to help determine presence of argillic horizons in clayey soils; (2) W. van der Kevie, FAO soil survey technical officer, to discuss Acid Sulfate Soils of Thailand; (3) J. D. Cowie, FAO land classification specialist and soil correlator to discuss soil correlation procedures in Thailand; (4) G. H. Robinson, FAO project manager, to discuss soil survey operations in Thailand;

(5) Thamrong Charasaiya, DLD Thai soil survey supervisor, to advise on minor changes he wanted to make in a paper he was presenting on the classification of some soils of Thailand at the conference the next day; (6) Dongcheep Ratananupong, DLD soil survey interpretations division, to discuss the development and use of hydrologic soil groups in Thailand.

1/6-9	Participated in First ASEAN Soil Conference, Kasetsart University, Bangkok. Presented paper, Application of Soil Taxonomy (7th Approximation) to Soil Surveys.
1/10	Worked on outline for lecture on soil classification to be presented to delegates of the ASEAN Soil Conference at Chiang Mai on January 16 at the request of the Thai Soil Survey Division staff.
1/11	Soil study excursion number 1 through the southern part of the Bangkok Plain with ASEAN delegates (by bus).
1/12-13	Soil study excursion number 2 through southeast coast region of Thailand with ASEAN delegates (by bus).
1/14	At USOM office, Bangkok. Conference with J. D. Schott concerning SCS-PASA program in Thailand and with Mr. Camden, formerly of Emmett County, Iowa, about the soil survey program in Thailand. Finished notes for January 16 lecture.
1/15-17	Soil study excursion number 3 in North Thailand with ASEAN delegates (by air and bus). Presented lecture on soil classification to ASEAN delegates, night of January 16, at Chiang Mai Railroad Hotel.
1/18	At Bangkok. Compiled notes on soil excursions.
1/19-21	Left Bangkok by Landrover truck for soil study excursion number 4 to Northeast Thailand with FAO advisor and seven DLD Soil Survey Division supervisors as follows: J. D. Cowie (FAO), Sirichai Kittayarak, Chaleo Changprai, Prompan Snitwongsi, Thumrong Charasaiya, Boonplook Khunthong, Somnuk Nonthapund, and Adul Chotimon (all Thai Soil Survey Division). Bangkok to Korat to Khon Kaen to Udon by Landrover truck, return Udon to Bangkok by plane arriving Bangkok, 5:30 p.m., January 21.
1/22	Soil study excursion number 5 (by car) with W. van der Kevie (FAO) to study Acid Sulfate Soils in the alluvial plains north of Bangkok. Developed tentative definitions for the classification of these soils.

1/23-25 Soil study excursion number 6 to South Thailand. With J. Dale Schott (SCS-PASA), F. J. Dent (FAO), and the following from DLD Soil Survey Division: Samarn Panichapong, Thumrong Charasaiya, Chaleo Changprai, Surapon Chareonpong, and Pisut Vichansorn. Bangkok to Songkhla by air, Songkhla to Phuket by Landrover truck, Phuket to Bangkok by air.

1/26 In morning had conferences with G. H. Robinson (FAO) regarding soil survey program in Thailand and with Arnold M. Snowden (SCS-PASA engineer) regarding hydrologic soil groups for Thailand soils. Lunch meeting with J. Dale Schott (SCS-PASA), R. Fowler (Acting Asst. Director, Agr. Dev., USOM), Wayne Reitz (TDY-HEW-U.S.), and Arnold M. Snowden. In afternoon, worked with W. van der Kevie revising definitions for classification of Acid Sulfate Soils and studying laboratory data.

1/27 Conferences to present oral reports of my TDY activities in Thailand at (1) USOM headquarters, Bangkok, with F. F. Simmons (Dy. Dir. USOM), R. Fowler (Acting Asst. Dir. Agri. Dev. USOM), and J. Dale Schott; (2) Ministry of National Development, Bangkok, with Bancherd Balankura (Director-General, DLD), and J. Dale Schott; (3) Ministry of National Development with Prinya Chavalittamrong (Dy. Undersecretary, Min. Nat. Dev. (directs DLD and three other departments) and J. Dale Schott; (4) Ministry of National Development with Mr. Sawaeng (Dy. Undersecretary, Min. Nat. Dev. (directs Royal Irrigation and three other departments) and J. Dale Schott; (5) Ministry of Nat. Dev. with Chaiyong Chuchart (Sr. Economist and Chief of Land Policy Div., DLD), and J. Dale Schott. Mr. Chaiyong was interested in using soil survey information for broad-scale planning and especially as it may help in resolving the current problems connected with the approximately 300,000 (his estimate) to 500,000 (Fowler-USOM estimate) families in North Thailand that are practicing shifting cultivation. (FAO, 1957, estimates at least 200,000,000 people and 36,000,000 sq. km. of land are involved in all tropical forest areas.)

1/28 Worked in office all day organizing notes on soil study excursions and drafting outline for written report.

1/29 In morning went to DLD headquarters, Bangkhen, for final conferences with DLD soil survey and FAO staff. Luncheon meeting with J. Dale Schott, G. H. Robinson (FAO Project Mgr.), G. W. Arnott (FAO-Lab.), and Robert W. Palmer (SCS-PASA advisor), to discuss continuation of soil survey interpretation advisory help to DLD that SCS-PASA started. Plans were that FAO may add an additional staff member to continue this advisory service.

In afternoon had conferences with J. D. Schott and Robert W. Palmer (SCS-PASA) at USOM office in Bangkok to discuss use of soil surveys in broad-scale planning, farm planning, and for other activities connected with soil and water conservation.

1/30 Breakfast meeting at my hotel (Mandarin) with J. D. Schott for final conference regarding my TDY activities, nature of written report to be submitted, and miscellaneous items regarding activities of SCS-PASA team.

Left hotel at 9 a.m. with R. Fowler, Wayne Reitz, and Robert Palmer for airport to leave Bangkok 11:20 a.m. for Washington, D.C.

Summary of 30 Days Spent in Thailand:

14 days in field studying soils
7 days of conferences with various officials
5 days preparing lecture notes and organizing data for field trips
4 days participating in ASEAN conference at Kasetsart University

APPENDIX IV

Officials worked with in Thailand in the field or conferred with relating to the USOM-SCS-PASA agricultural development program, or both:

1. Dr. F. F. Simmons - Deputy Director, USOM
2. Dr. Robert Fowler - Acting Asst. Dir. Agri. Dev., USOM
3. Mr. Milford Atwood - Information Advisor, USOM
4. Mr. Kenneth Hall - National Agri. Bank, Thailand
5. Mr. J. Dale Schott - SCS-PASA Team Leader
6. Mr. Robert W. Palmer - SCS-PASA Advisor
7. Mr. Arnold M. Snowden - SCS-PASA Advisor
8. Dr. Bancherd Balankura - Director-General, Dept. Land. Dev.
9. Mr. Prinya Chavalittamrong - Dy. Undersec., Min. of Nat. Deve.
10. Mr. Sawaeng - Dy. Undersec., Min. of Nat. Dev.
11. Dr. Chaiyong Chuchart - Chief of Land Policy Division, DLD
12. Mr. Ying Vajrakupta - Acting Chief Soil Survey Div., DLD
13. Mr. Samarn Panichapong - Asst. to Acting Chief, Soil Survey Div., DLD
14. Mr. Dongcheep Ratananupong - DLD Soil Interpretations Div.
15. Mr. Thamrong Charasaiya - DLD Soil Survey Division
16. Mr. Sirichai Kittayarak - DLD Soil Survey Division
17. Mr. Chaleo Changprai - DLD Soil Survey Division
18. Mr. Prompan Snitwongsi - DLD Soil SurveyDivision
19. Mr. Boonplook Khunthong - DLD Soil Survey Division
20. Mr. Somnuk Nonthapund - DLD Soil Survey Division
21. Mr. Adul Chotimon - DLD Soil Survey Division
22. Mr. Surapon Chareonpong - DLD Soil Survey Division
23. Mr. Pisut Vichansorn - DLD Soil Survey Division
24. Mr. Tanit Tongchutha - DLD Soil Survey Division
25. Mr. Fred W. Hasselaar - Hunting Technical Service
26. Mr. Prasert Bhodthipuks - Royal Forest Dept., Bangkok
27. Dr. Wayne Reitz - Chief, Graduate Program, HEW (on TDY, Thailand)
28. Dr. John W. Moffitt - Staff Psychologist, ARPA (Adv. Research Prog. Agency)
29. Dr. J. L. Charley - Thai-Australian Development Project
30. Dr. J. W. McGarity - Thai-Australian Development Project
31. Dr. H. F. Massey - Chief, University of Kentucky Team, Khon Kaen
32. Mr. G. J. Smith - Khon Kaen University, Khon Kaen
33. Dr. G. H. Robinson - Project Mgr., FAO-Soil Survey Project
34. Mr. J. D. Cowie - FAO Soil Survey Project
35. Mr. W. van der Kevie - FAO Soil Survey Project
36. Mr. F. J. Dent - FAO Soil Survey Project
37. Mr. G. W. Arnott - FAO Soil Survey Project
38. Mr. J. J. Scholten - FAO Soil Survey Project
39. Mr. F. Bos - FAO Soil Survey Project

In addition, some interviews or field work, or both, were conducted with others not listed above from the Royal Thai Government, USOM, FAO, Kasetsart University, and delegates from Indonesia and Malaysia participating in the ASEAN Soil Conference.

The notes included in this appendix were recorded on six field excursions in Thailand during the period January 11 to 25, 1970. The suggested placement of the soils in the Taxonomy should be considered tentative. The time available for studying the soils was limited, and supporting laboratory data was not available to confirm the field estimation of some of the important soil characteristics. Most of the soil descriptions, site locations, and information on climate, topography, physiography, vegetation, and land use are given in the Excursion Guide, First ASEAN Soil Conference, January 6-17, 1970, Bangkok, Thailand, a document published by the General Secretary of the ASEAN Conference and distributed to all delegates at the conference. Soil descriptions for sites not included in the guide are referenced by series name and profile code number to descriptions on file at the DLD Soil Survey Division headquarters or FAO in Bangkok. Brief notes are included in this appendix for a few soils that were observed but for which descriptions are not available, neither in the guide nor in Bangkok. All ASEAN delegates (about 80) were included in the party on excursions 1, 2, and 3. Party members for excursions 4,5, and 6 are noted under the respective dates in the itinerary, Appendix III.

<u>Field Excursion 1</u> - Southern part Bangkok Plains, Thailand, January 11, 1970:

1. Profile No. C 9/1, Thon Buri series, - Vertic Tropaquept. The 0-30 cm layer of this soil was an overlay caused by making raised beds for fruit crops in a wet soil. The soil is clayey throughout, cracks in the dry season deeper than 50 cm, and has many slickensides; however, the slickensides do not intersect.

2. Vertic Tropaquept. Site located in the Bangkok Plains near Thon Buri in a rice field that was being harvested on this date. Site is representative of the Bang Len soil series, a nonacid marine soil. The soil, observed by boring a hole with an open blade type soil auger, has a clay texture throughout. The matrix is dark gray with reddish brown mottles along root channels. The soil was just beginning to dry out after being wet from the previous rice crop, and cracks were only 20 to 30 cm deep; however, local soil scientists said the soil cracked deeper than 50 cm as the dry season progressed. This soil has high potential relative to other soils in the immediate area for growing rice. The estimated yield is about 1500 kg rice per hectare, using 94 kg of 16-20-0 fertilizer per ha applied in split equal applications at transplant time and seed head time.

3. Profile No. SW 53/2, Kampaeng series - Arent. A significant part of the soil has been mixed as evidenced by pieces of brick scattered throughout the solum.

Field Excursion 2 - Southeast Coast Thailand, January 12-13, 1970:

4. Profile No. SE1, Si Racha series - Haplustox or Oxic Ustropept. Additional laboratory data is needed to confirm the presence of an oxic horizon in this soil.

5. Profile No. SE3, Chumpon series - Paleustult. Placing this soil in a skeletal family would indicate the presence of ironstone (laterite) gravels below 29 cm. Some roots are penetrating through the gravels which indicate they are not as restricting as may occur in an indurated and continuous petroferric contact.

6. Profile No. SE 4, Tha Mai series - Rhodic Paleudult. The argillic horizon extends to over 1.5 m from the surface. The base saturation is low, and the cation exchange capacity per 100 g clay is low.

Field Excursion 3 - North Thailand, January 15-17, 1970:

7. Profile N 38/13, Hang Dong series - Aeric Tropaqualf. This soil has a thick argillic horizon that extends to over 1.5 m from the surface and no abrupt textural change between the epipedon and the argillic horizon. This soil suggests the need for a great group of Paleaqualfs.

8. Profile N-38/11, Hang chat series - Oxic Paleustult.

9. Profile N-35/28, Mae Rim series - Typic Paleustult.

10. Profile N-35/1, Mae Taeng series - Rhodic Paleustult. This soil is in hydrologic group B.

11. Profile 35/30, Tha Muang series - Ustifluvent, fine-loamy, mixed, isohyperthermic. This soil floods each year and receives annual deposits of fresh alluvium. The organic matter decreases irregularly with depth.

12. Profile -35/29, Nakhon Sawan series - Oxic Tropudult, clayey, kaolinitic.

13. Profile N 35-33, UA series - Typic Tropaqualf. This soil has a thick argillic horizon that is estimated to extend deeper than 1.5 m from the surface and no abrupt textural change between the epipedon and the argillic horizon. This soil suggests the need for a great group of Paleaqualfs.

Field Excursion 4 - Northeast Thailand, January 19-21, 1970:

14. Site located 67 km north of Bangkok on west side of highway to Saraburi. Observed a soil in a rice field that local soil scientists included in the Rangsit series. A brief description obtained by boring a hole with an open blade type soil auger follows:

0-30 cm. Black (10YR 2/1; moist) clay, few brown mottles along root channels; weak medium subangular blocky structure; pH, field moist, 5.0 (Hellige).

30-60 cm. Brown (7.5 YR 5/2; moist) clay, many distinct red (2.5 YR 416), common dark yellowish brown (10YR 3/6) and few brownish yellow (10YR 6/8 - not jarosite) mottles, and some soft manganese concretions; pH, field moist, 4.5 (Hellige).

60-80 cm. Grayish brown (10YR 5/2; moist) clay, many red (2.5YR 4/8) mottles; pH field moist, 4.0 (Hellige).

80-137 cm. Grayish brown (10YR 5/2; moist) clay, many yellow (5Y 8/6) jarosite mottles and few red (5YR 4/6) mottles; few fine gypsum crystals; some slickensides; pH, field moist, 4.0 (Hellige).

137-240 cm. Dark gray (10YR 4/1; moist) clay. Remarks: The water in the bore hole was 30 cm from the soil surface within 30 minutes of boring the hole. The rice yield on this soil was estimated at 20 to 30 tang per rai (1100 to 1650 pounds per acre). It is expected that these low to moderate yields can be maintained if the soil is kept wet during most of the year to prevent the formation of excess acids. This soil is classified locally as an Acid Sulfate or soil with "cat clay." However, it is not one of the most strongly affected because the soil contains gypsum as a result of neutralization of some of the acids by calcium carbonate brought in with the sediments from rivers that flood the local area. A new subgroup proposed for this kind of soil is Thionic Tropaquept. This and several other Tropaquepts observed in the Bangkok Plains form deep cracks in the dry season and have slickensides below the surface layer. The shrink-swell potential of these soils should be measured to confirm vertic characteristics.

15. Profile NE1, Tha Kli series - Eutropeptic Rendoll. This soil is developed in colluvium from limestone and is about 60 cm deep to hard limestone gravels or bedrock. The field in which the site is located was producing moderate yields of corn and castor beans although the stands were poor and weeds and insect damage prevalent. The resident farmer reported corn yields of 35 bu. per acre without fertilizer.

16. Profile NE2, Pak Chong series - Rhodic Paleustalf. The argillic horizon at this site is thought to extend deeper than 1.5 m from the surface although the depth was not confirmed. If the argillic horizon does not extend to 1.5 m, the profile would be classified as Haplustalf.

17. Profile NE3, Korat series - Suggested tentative classification for this profile is Oxic Dystropept. Current field and laboratory studies by Thailand soil scientists are being conducted on this and other soils locally classified as Grey Podzolic. The results should be helpful in understanding their genesis, characteristics, and other features necessary for their classification.

18. Site located about 13 km northeast of Korat on west side of road to Lamkhai. Observed a soil in a road bank that local soil scientists included in the Warin series and classified Red-Yellow Podzolic. The soil developed in sandstone on an upland plateau. The natural vegetation is dwarf Dipterocarp trees and elephant grass. Some shifting cultivation is practiced in the area. The organic matter is low throughout the profile, less than about one-half percent. Suggested classification in the Taxonomy is Typic Dystropept. Brief notes on the profile follow:

0-8 cm.	Dark brown (7.5YR 4/4) loamy sand (about 10% clay).
8-40 cm.	Strong brown (7.5YR 5/6) fine sandy loam.
40 cm plus.	Sandy loam. The pH is about 4.8 to 5.0 throughout and the base saturation is estimated to be less than 60%. The soil is in hydrologic group B.

19. Site located about 150 meters north of the highway near the village of Thalatka, in a pit about 6x10x2 meters in dimension. (The pit was being dug for a farm water supply.) The local soil scientists included this soil in the Phimai series, a hydromorphic alluvial soil. The suggested classification in the Soil Taxonomy is Vertic Tropaquept. Brief notes on the profile follow:

0-12 cm.	Grayish brown (10YR 5/2; moist) light brownish gray (10YR 6/2; dry) clay, many medium distinct brownish yellow (10YR 6/8) mottles; massive.

12-40 cm. Gray (10YR 5/1; moist) clay, many fine and medium distinct light olive brown (2.5Y 5/4) and yellowish brown (10YR 5/8) mottles; moderate fine and medium subangular blocky structure.

40-150 cm. Gray (10YR 5/1; moist) clay, many distinct high chroma mottles; many slickensides but not intersecting. Remarks: Wide cracks over 1 m deep form during the approximate 5 months the soil is dry. This soil is in hydrologic group D.

20. Observed another profile of the Korat series (see profile NE3 stop 17) in a deep ditch that was being excavated on the NE Agricultural Center, Khon Kaen. This soil is similar to profile NE 3 except the texture below the surface horizon is sandy loam instead of sandy clay loam; however, the suggested classification at the great group level remains the same.

21. Profile NE 5, Yasothon series - Typic Haplustox.

22. Site located in a road bank about 25 km northeast of Khon Kaen on west side of highway to Udon. This is a shallow loamy sand soil with about 60 percent quartzite and ironstone gravels. Local soil scientists included it in the Sakon series. The suggested placement in the Taxonomy is in a sandy-skeletal family of Lithic Ustorthents.

23. Site located about 52 km northeast of Khon Kaen on the highway to Udon. Local soil scientists placed this soil in the Phon Phi Say series, a Red-Yellow Podzolic soil. The suggested placement in the Taxonomy is in a loamy-skeletal, mixed, isohyperthermic family of Ultic Paleustalfs. Brief notes follow:

0-10 cm. Brown (7.5YR 5/3; moist) loamy sand; massive.
10-20 cm. Sandy loam; weak granular and weak subangular blocky structure.
20-150 cm. Sandy clay loam; moderate medium subangular blocky structure; about 40 percent ironstone and coated hard sandstone gravels; patchy clay skins.

Estimated bore saturation in the argillic horizon is less than 75 but over 35 percent, and the cation exchange capacity is less than 24 meg./100 g clay.

24. Site located about 79 km northeast of Khon Kaen on the highway to Udon. Local soil scientists placed this soil in the Roi Et series,

saline phase, Low Humic Gley. (See sample description of Roi Et series in guide, site NE4.) The suggested placement in the Taxonomy for the site observed is Abruptic Tropaqualf. Brief notes for the site follow:

0-15 cm.	Very fine sandy loam; pH 6.5.
15-40 cm.	Brown (7.5YR 5/2; moist) silty clay loam or silty clay, common distinct yellowish brown (10YR 5/6) mottles; strong coarse prismatic structure; pH 7.0.
40-70 cm.	Grayish brown (10YR 5/2, moist) sandy loam, common distinct reddish yellow (7.5YR 6/7) mottles, moderate medium subangular blocky structure; clay films; pH 8.0. Watertable at 70 cm.

Field Excursion 5 - South Bangkok Plains, Thailand, January 22, 1970:

25. Rangsit series (local classification, Acid Sulfate Soil). Thionic Tropaquept. The soil also has vertic characteristics. The site was located in a rice field on the west side of the highway, about 35 km north of Bangkok on the highway to Ayutthaya. Brief notes for this site follow:

0-15 cm.	Black (10YR 2/1; moist) clay; no mottles.
15-45 cm.	Brown (7.5YR 5/2; moist) clay, common brownish yellow (10YR 6/8) and dark yellowish brown (10YR 3/6) mottles.
45-70 cm.	Brown clay, few medium distinct straw-yellow jarosite mottles, many red (5YR 4/6) and brownish yellow mottles, common slickensides.
70-140 cm.	Grayish brown clay, many medium distinct straw-yellow jarosite mottles; N value below 0.5.
140-220 cm.	Dark gray clay, few brown mottles; N value above 0.5.

Field test with 12 percent cold hydrochloric acid produced no H_2S odor so sulfides present are thought to be in the form of pyrites (FeS_2), not iron monosulfides (FeS). This soil cracks to 50 cm in the dry season, and the water table fluctuates between about 1.5 m below the surface in the dry season to about 1.5 m above the surface during the wet monsoon season. The water in the auger hole had risen to 36 cm from the surface within about 30 minutes after boring the hole. The soil never dries out completely below about 70 cm. No gypsum was observed in the profile; however, some very fine crystals may be present if examined in thin section. The rice yield is about 1200 to 1500 kg per ha (1050 to 1300 lbs. per acre).

26. Site located in the Bangkok Plains northeast of Bangkok, about 30 km east of Bang Khen. We looked for an example of the Bang Khen series, local classification, Acid Sulfate Soil, but did not find one. The soils here had red mottles, which indicated they were acid enough to turn the iron red, but the field moist pH was about 6.5 or 5.0 and dropped to only 6 or 4.5 upon drying. The brownish yellow mottles in the upper 1 m were not jarosite. The soils are typically gray clay with N value less than 0.5 to 1 m, have N value over 0.5 below 1 m, and are green below about 2 m. Higher rice yields were evident here compared with Rangsit soils; however, no other characteristic landscape features were noted that would be helpful as field clues to separate the various degrees of acid sulfate-affected soils into soil series and higher categories. It appears that detailed examination of the soils by digging and boring numerous holes combined with field and laboratory tests are required to make accurate separations on soil maps. The soils observed in this immediate area do not meet the criteria for thionic intergrades because no jarosite or low pH values are apparent.

27. In Bangkok Plains northeast of Bangkok, about 31 km east of Bang Khen, or about 1 km east of stop 26, vicinity of Ban Nam Prieo (literally acid water village).

The soil at this site is a Thionic Tropaquept. Jarosite mottles are present between 50 and 150 cm of the soil surface and the dry pH is less than 4.0 in some part. The N value is over 0.5 below 1 m. Rice yields are moderate. The pH with depth is:

	Dry	Fresh		Dry	Fresh
0-23 cm	4.2	4.6	96-114 cm	4.5	4.5
23-54 cm	4.2	4.4	114-160 cm	2.7	4.8
54-96 cm	4.0	4.3	160+ cm	3.4	7.3

28. In Bangkok Plains northeast of Bangkok, on Sukhunvit road near Bang Pakong.

This site is in a salty, wet, flat area. The vegetation is mainly red salt tolerant shrubs that resemble heath in growth form. The 0-50 cm layer is brown, N value less than 0.5, and has weak soil structure. The soil is blue and green below 50 cm and has an N value much over 0.5. Tropaquept (hydric) or Hydraquent is suggested for its classification in the Taxonomy.

29. In Bangkok Plains east of Bangkok. Cha Am series (cat clay). Thionaquept.

Attempts to reclaim this soil by draining a mangrove swamp about 20 years ago have not been successful. Rice yields were reported to be higher before the soil was well oxidized after draining but have dropped below 1000 kg per hectare and now fish farming by pumping and maintaining high water levels appears to be the most profitable and satisfactory land use for the soils. Sulfur is more than 1 percent throughout the soil and the pH is low where the soils have dried and oxidized.

Field Excursion 6 - South Thailand, January 23-25, 1970:

30. Profile of Hat Yai series. Typic Paleudult, clayey-skeletal, kaolinitic, isohyperthermic.

Site located about 10 km northeast of Hat Yai, in Songkhla Changwat, near village of Moo Bhan. See profile description in R.R.C. Report No. 768SK5-10 and data for profile code number S 68/9.

This soil is class III for rubber. Native legume plants have nodules on the roots in the first 15 cm. but none below. The base supply of the soil is low. Laboratory data shows the 14-28 cm layer has 0.2 meg of calcium per 100 g soil.

31. Site at Rubber Research Centre, Hat Yai.

Two soils were observed in a rubber plantation near the headquarters of this research station. The soils are similar except for drainage. The sites are located about 100 m apart in slightly different topographic positions.

Nam Krachai series. For description see Profile Code No. RDP-SK-2. The site observed is an intergrade to Aquox. Based on a brief study of the soil and laboratory information furnished by Mr. Marijnissen, a suggested classification is Aquoxic Dystropept, coarse-loamy, kaolinitic, isohyperthermic.

32. Site at Rubber Research Centre, Hat Yai. Kohong series.

For description see Profile Code No. RDP-SK-1. Suggested classification is Oxic Dystropept, coarse-loamy, kaolinitic isohyperthermic. This site is class II for rubber (also class II land use capability). This Kohong soil is about 2 m higher in elevation than the Nam Krachai soil, and this slight difference in relief makes considerable difference in drainage between the two soils.

33. Profile RDP-SK-7, Sadao series - Ustox. See profile RDP-SK-7 for location, soil description, and laboratory data.

34. Profile RDP-TG-4, Trang series - Rhodic Paleudult.

See profile RDP-TG-4 for location, soil description, and laboratory data. This site is class I for rubber. Fertilizer application on rubber trees is 10 to 20 kg per rai (55 to 110 pounds per acre) of 16-16-4-4 (the last 4 is magnesium, included in the mixture as magnesium sulfate) on solid mature stands, broadcast annually or sometimes once per two years, between tree rows.

The argillic horizon was examined to 170 cm and clay films are common to that depth.

35. Profile RDP-TG-1, Ao Luk series - Rhodic Paleudult.

See profile RDP-TG-1 for soil description and laboratory data. The site is located on the Nai Chong Rubber Research Station in a sloping field recently planted to bananas. This soil has low cation exchange capacity in respect to the clay and is an intergrade to Oxisols, a feature that is common to many Paleudults. The argillic horizon in this soil extended below 1.5 m from the surface. Large peds in the argillic horizon part to very fine subangular blocky structure.

36. Profile RDP-PG-1, Phuket series - Typic Paleudult. Note this soil is an intergrade to Oxisols. This feature is common in Paleudults; consequently, no oxic subgroups have been provided as yet in the Taxonomy.

See profile RDP-PG-1 for soil description, location, and laboratory data. The site is located in a road bank near the highway about half the distance between the bridge to Phuket Island and the town of Phuket. This soil is class I to II for rubber. It is developed on a terrace in granite alluvium.

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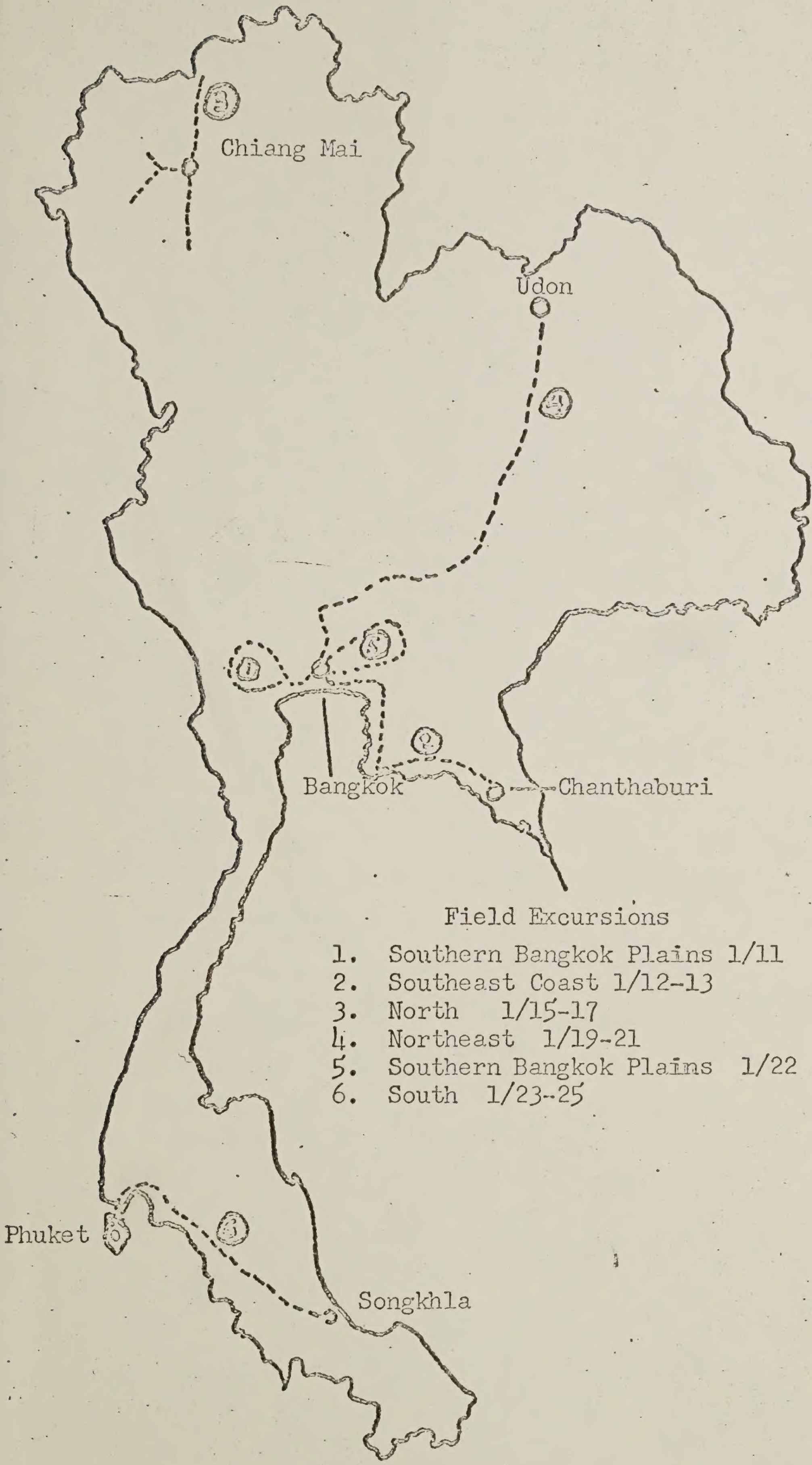

Field Excursions

1. Southern Bangkok Plains 1/11
2. Southeast Coast 1/12-13
3. North 1/15-17
4. Northeast 1/19-21
5. Southern Bangkok Plains 1/22
6. South 1/23-25